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# CULTURAL FEATURES AND THE PHYSIOGRAPHIC CYCLE

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Does geographical environment control human distributions, industries, habits, customs, and other activities and qualities? How far does this control extend and through what agencies does it operate? These are some of the fundamental problems of geography. In an attempt to put the investigation of at least one aspect of the broader problem on a detailed quantitative basis, the writer has set the following query: To what extent are the location and distribution of cultural features, such as towns and clearings in the forests, controlled by topography; and how closely may the facts of location and distribution be correlated with recognized stages in the normal physiographic cycle? No attempt is here made to determine the effects of complications in the cycle.

## STAGES IN THE PHYSIOGRAPHIC CYCLE

In order that there may be no confusion of meaning in the use of the terms that designate the various stages of the physiographic cycle, the essential topographic characteristics of each stage are stated briefly:

*Youth:* The greater part of the original upland surface still intact; valleys narrow, steep-sided, and without prominent flood-plains.

*Late youth:* Valleys wider and considerable parts of the original upland still undissected.

*Early maturity:* Fragments of the original upland still remaining, but occupying less than one-fourth of the area; valleys narrow and steep-sided, with minor bottom lands here and there along the larger streams.

*Maturity:* Original upland completely dissected; V-shaped valleys and ridgelike divides; slopes steep; flood-plains narrow and mainly along larger streams; valley-side profiles nearly straight lines, or convex upward.

*Late maturity:* Valleys wider at the bottom than in maturity; lower slopes gentle; upper slopes steep; divides narrow and relatively sharp; flood-plains conspicuous along streams; valley-side profiles concave upward.

*Old age:* Lower slopes gentle and valley bottoms wide; divide ridges narrow and becoming lower as the age increases; flood-plains broad.

*Extreme old age:* All slopes gentle; divides low and narrow; flood-plains broad.

## CULTURAL FEATURES

For the sake of definiteness and simplicity, only four types of cultural features have been considered. These are: clearings in the forests (on maps

on which forests are shown), roads, houses, and towns. All of these are represented on the accompanying maps (forests being indicated by a darker tint on Figs. 4 and 5). Each of them is vitally related to the life and occupations of the people. From their location and distribution much can be determined concerning the life and work of the people, the nature of their farms, and the physical and social difficulties against which they must contend.

#### METHOD OF WORK

In order that the investigation might be put upon a quantitative basis and freed from personal errors the following procedure was adopted:

1. From the latest topographic maps, all on the same scale, a number of examples of topography in various stages of the physiographic cycle were chosen.

2. For study, a definite and uniform area, namely a five-minute rectangle on each map, was selected, care being taken to choose an area having a uniform type of topography throughout.

3. A graph was prepared, and the stages in the cycle were plotted along the horizontal axis, and percentages along the vertical axis. The stages represented were youth, late youth, early maturity, maturity, late maturity, old age, and extreme old age. The cycle was thus rather minutely subdivided in order to facilitate the placing of regions whose stages are intermediate between youth, maturity, old age, and the final stage of extreme old age.

4. Each area chosen for study was next classified under its appropriate heading and its proper position on the graph was plotted.

5. All roads on each rectangle were then measured and classified, as to location, in the following groups:

- (a) Bottoms. Roads along valley bottoms close to streams or on the stream flood-plains.

- (b) Interfluves or uplands. Roads on the upland ridges and divides.

- (c) Slopes. Roads distinctly on valley slopes, extending either along or up and down the slopes, unless distinctly pass roads.

- (d) Passes. Roads across valleys from upland to upland, or across divides from valley to valley.

The mileage under each classification was determined and its percentage of the total was calculated and plotted on the graph for roads, Figure 1. The same procedure was followed and the same classification was made for houses and towns, except that on some sheets displaying uniform topography the towns of the entire quadrangle, or of considerable parts of it, were counted. Any group of ten or more houses was classed as a town.

The percentages for houses and towns on interfluves, bottoms, and slopes were then plotted on their respective graphs, Figures 2 and 3. Smooth curves were drawn as nearly as possible through the points thus located.

The construction of the graph for towns differs from that of the others in that the percentages for all the maps of each stage were averaged and this average was plotted at the center of the space for that stage, because the number of towns on most of the quadrangles was too small to give reliable results if plotted separately.

The areas measured and plotted on the graphs represent considerable variety both in locality and in relief for each of the stages. It is note-

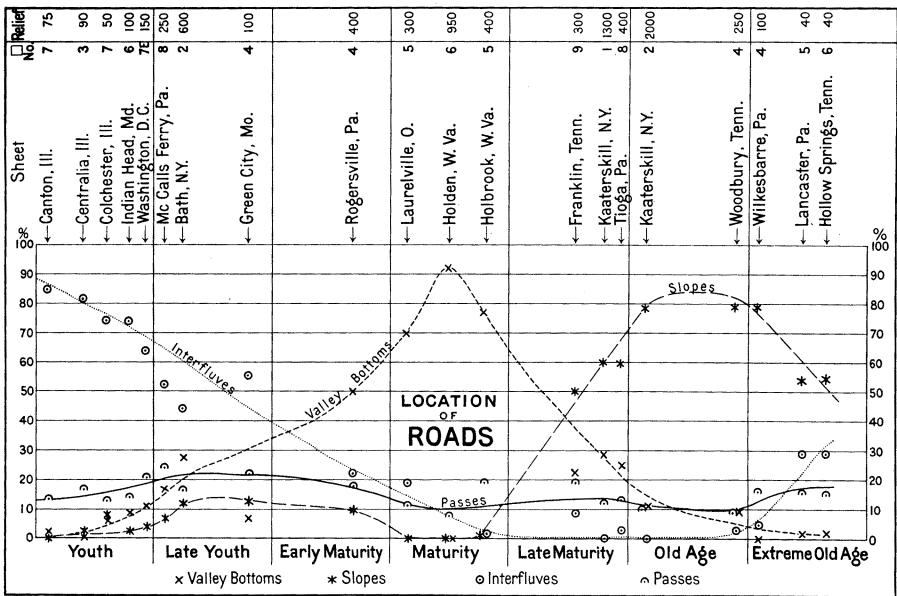


FIG. 1.—Diagram illustrating the relation between the location of roads and the physiographic stage of the topography.

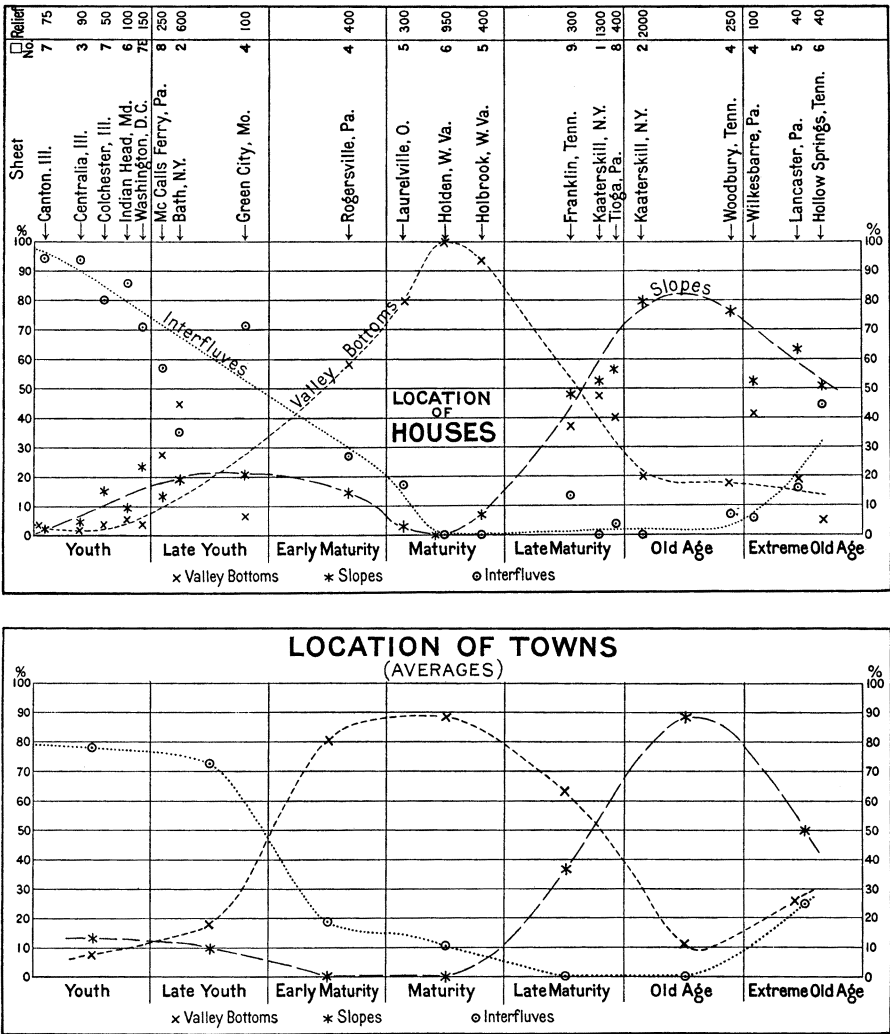
The stages of the physiographic cycle are plotted along the horizontal axis and the percentages of occurrence of roads on topography of a given stage along the vertical axis. Four types of roads are differentiated by symbol. The areas chosen for study, five-minute rectangles on the topographic sheets of the U. S. Geological Survey, are indicated in the upper part of the diagram, the position of each rectangle within its sheet being indicated by the numbers under the heading "□ No." (the nine rectangles, arranged in three rows of three, are numbered consecutively from left to right, beginning with the top and ending with the bottom row). The figures at the top of the diagram, headed "Relief," give the mean elevation in feet of each five-minute rectangle.

worthy that the correlation holds in its essentials for regions of considerable differences in relief, though it is plain that high relief tends to make the topographic control more nearly dominant.

#### ANALYSIS OF THE CURVES

*Houses.* In youth a large percentage—80 to 95—of the houses are on the uplands and only a few in the valley bottoms, Figure 2. On several of the maps a considerable number are located on the premature old-age topography at the heads of the larger valleys and are classified as on slopes. With advance toward maturity the percentage of houses on the

uplands decreases to zero, whereas for those on the valley bottoms it increases to 100. In late maturity and old age the percentage of houses on slopes increases to 60 or 75, while that for valley bottoms drops to less than 50. In extreme old age, locations on slopes and interfluvies dominate (the



FIGS. 2 and 3—Diagrams illustrating the relation between the location of houses and towns and the physiographic stage of the topography. For explanation of symbolism, see Fig. 1.

abrupt falling off of the curve for valley bottoms is due to slight rejuvenation in all the areas measured).

*Roads and Towns.* The graph for roads, Figure 1, repeats the essential features of that for houses, as would of course be expected. The only

noteworthy difference is the addition of the curve for "passes" which lies very uniformly between 10 and 25 per cent. The rise to 25 per cent in late youth is due to the increased width of the valleys while culture is still mainly on the uplands. The sharp rise of the road curve for "interfluves" and the fall for "bottoms" is similar to that for houses and is due to the same cause. The graph for towns, Figure 3, repeats all the essential features of the other two.

The graphs show clearly that there is a close correlation between the enumerated cultural features and the specified stages in the physiographic cycle. In nearly all instances the percentages for the different regions fall surprisingly close to the general curve. The similarity in the form of the curves for each of the three cultural features shows that the location of all is controlled in essentially the same way by the topography and that all are capable of the same topographic correlation. The location of cleared land, though not measured quantitatively, may readily be seen to accord with that of the other features. For the purposes of the following summary statement of the correlation it is, therefore, possible to group houses, towns, roads, and clearings together under the general head of "cultural features."

#### SUMMARY STATEMENT OF THE RELATION OF CULTURAL FEATURES TO STAGES IN THE PHYSIOGRAPHIC CYCLE

The correlations implied in the graphs may be verbally expressed as follows:

In youth what may be called *upland culture* prevails to the extent of 60 to 90 per cent of the total. Houses, farms, roads, and towns are on the uplands. Valleys are avoided and as a rule are left forested. The valleys are crossed only in passing from one upland to another (see Fig. 4).

As the stage of the topography approaches maturity and the flat upland areas decrease in relative proportions and the flats along the streams increase, there is every gradation to the second principal stage, maturity.

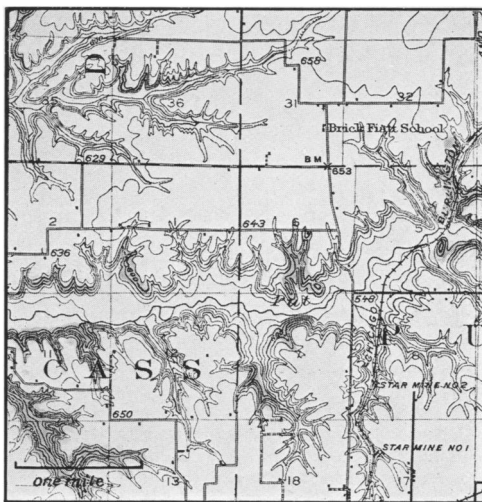


FIG. 4—Youthful topography on the plains of Illinois. Part of Canton, Ill., quadrangle, five-minute rectangle No. 7 (see explanation under Fig. 1). Note that culture is almost exclusively on the uplands. The eighth, quarter, and half-mile jogs of the roads by which the section-line system is made to conform to the topography is well illustrated in the southwest corner of the map.

The distribution of culture follows very closely that of the flatter land both in location and in percentage.

In maturity, with steep slopes and narrow ridge divides, *valley-bottom culture* prevails almost to the exclusion of all other types. All cultural features

are closely confined to the valleys, and the uplands and slopes are, in general, avoided (Fig. 5).

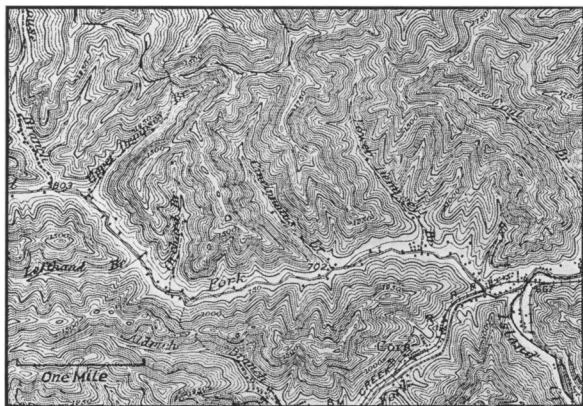


FIG. 5—Typical mature topography in a region of considerable relief. Holden, W. Va., quadrangle, rectangle No. 6. Note the exclusive development of "valley bottom culture."

In late maturity and old age, when the valleys are wide and their lower slopes are gentle, *slope culture* predominates. All cultural features are prevailingly located on the slopes part way up from the streams. In valleys of considerable relief the roads with accompany-

ing houses are most commonly built along the valleys part way up the slopes (see Figs. 6 and 7). The reasons for this location seem to be that thus the stream flood-plains and cut-bluffs are avoided, the ground is drier, and the houses are located nearer the centers of farms which extend from valley bottom to divide.

The correlation with the extreme old age stage cannot be satisfactorily made from the data on the graphs because of the slight rejuvenation which all the regions seem to have suffered. There is nevertheless a distinct tendency toward the development of the *unguided* culture, which would be expected as the plains condition is approached, and which is the characteristic type on plains.

#### BASIS OF THE TOPOGRAPHIC CONTROL OF THE LOCATION OF CULTURAL FEATURES

Topography, in its relation to human activities, may be analyzed into three components—relief, including elevation; slope, or inclination of the surface; and exposure.

Relief exerts its most direct and powerful influence through the work which must be done against gravity in ascending from one level to another. To escape the necessity of performing this work man avoids hill ascents whenever and wherever possible, consequently all cultural features tend to be so located with respect to the outside world and to one another that the least possible amount of climbing is necessary. In consequence, if the farms

of a region are on the uplands, there is a tendency for all the other cultural features to be located there also. Certain features, such as railroads, are more sensitive to gravity effects than others and are, therefore, more strictly limited in their location. They may, for instance, be confined to the valley bottoms in regions where all the other cultural features are on the slopes or the uplands. A good example of this is found on the Fayetteville, West Virginia, quadrangle, where the through-line railroads are confined to the valley of New River, though all other cultural features of the region, except certain coal mines and railroad towns, are on the uplands. Where the relief is great, the effect of altitude on temperature may be great enough to assume prime importance.

In its influence on human activities, particularly where agriculture is the prevailing industry, doubtless slope declivity is the most important single element of the topography. On slope depends the rate of run-off of the rainfall, and, to a large degree, the character of the soils, since the finer materials tend to

be washed off the steeper slopes and the coarser, stony materials to be concentrated and left behind. Ease of cultivation is similarly conditioned by slope gradients. In all these respects the gentler slopes are most favorable, though there are exceptions due to specialized industries like the grape-growing of the Rhine valley, where exposure exerts the dominating control. The influence of exposure to sun and wind varies greatly under different conditions of climate. It is exerted directly, as well as indirectly through agriculture.

Of the three components of topography, slope seems to be the one which exerts the strongest influence over the location of cultural features in the regions included in this study. The graphs drawn to show the location of these features in relation to topography and stage in the cycle might almost as well be used to express the location of the flat or more gently sloping land, so closely do the two correspond. To express the idea briefly: *The*

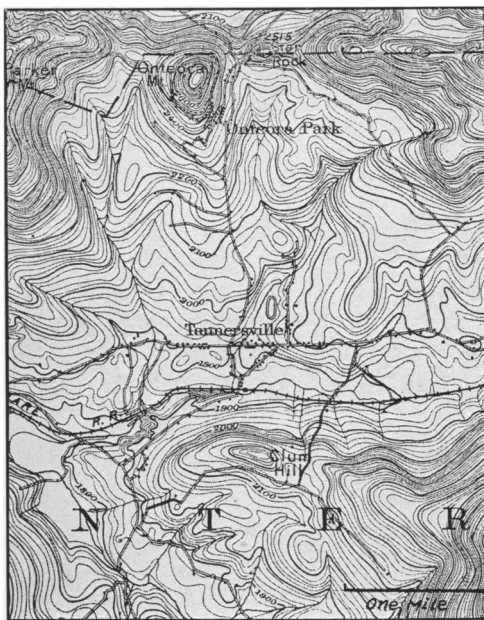


FIG. 6—A specimen of late-mature or early-old-age topography on which slope culture is well developed. Kaaterskill, N. Y., quadrangle, rectangle No. 2. Onteora Park, a summer resort, probably owes its location abnormally high on the slope to a combination of the factors of elevation and the excellent view which the location commands.



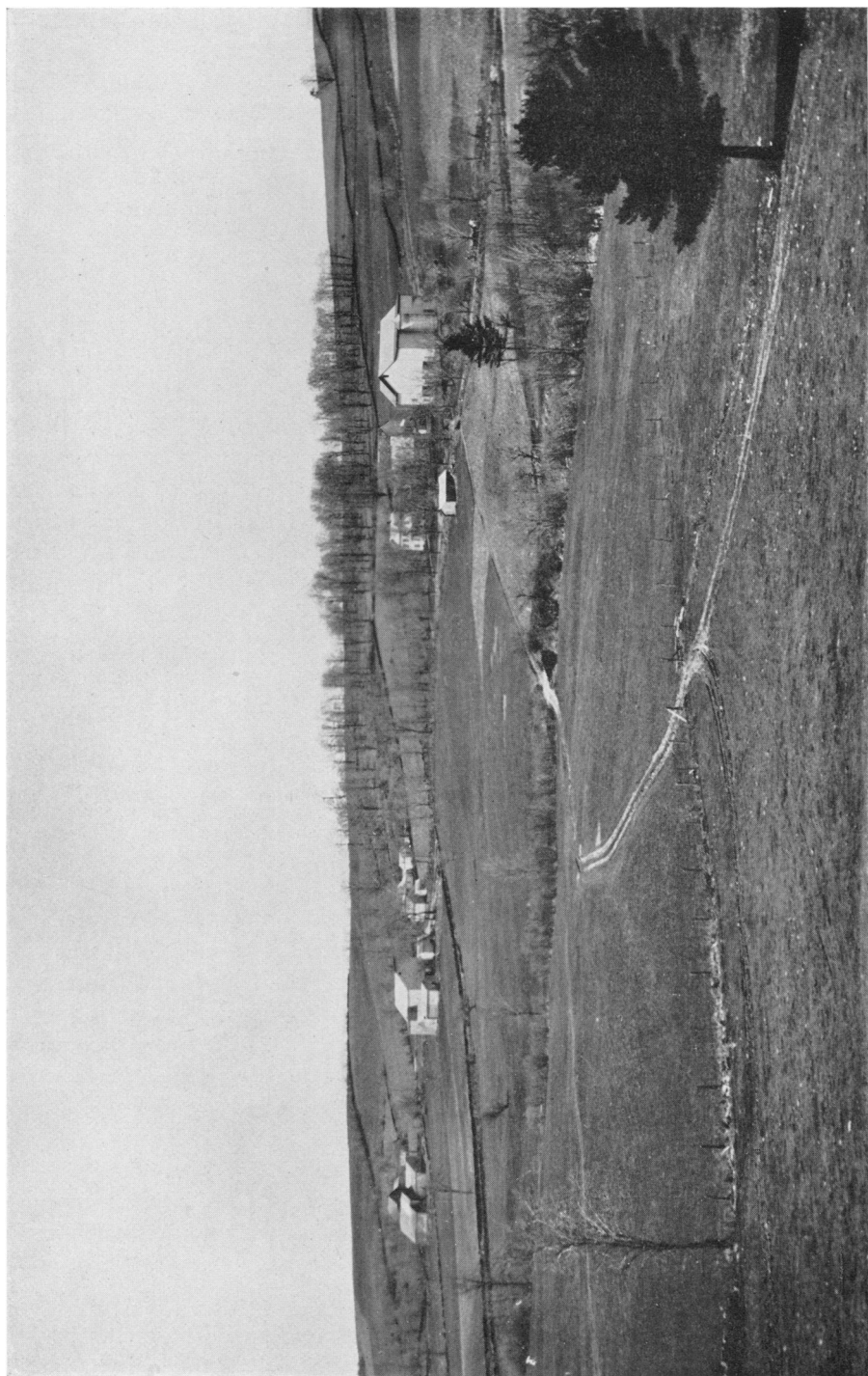


FIG. 7.—Slope culture in a late-mature valley in the Catskills (valley of Town Brook, Hobart, N. Y., quadrangle). Houses, roads, and the most important parts of the farms are on the slopes well above the valley bottoms.

*topographic control over the location of cultural features is exerted mainly through the agency of slope supplemented by relief and, to a less degree, by exposure.*

Such a close relation between slope and the distribution of cultural features is to be expected, particularly in a region like the United States, where agriculture on an extensive rather than an intensive scale is the prevailing industry. The farms are located on the more level land where the soil is best and cultivation is easiest. The houses and towns are located where the least amount of hill climbing is necessary in traveling from house to farm or from farm to town. The roads—the connecting links between these features—accord with them in location.

#### THE DOMINANCE OF TOPOGRAPHIC FACTORS IN CONTROLLING THE LOCATION OF CULTURAL FEATURES

To what degree topography dominates competing human factors in controlling the location of cultural features is a broad problem which has been touched upon only incidentally in connection with the present study. Two of the cultural features, namely towns and roads, supply data on the subject.

*Towns.* Towns of two types, rural or agricultural, and mining towns, are represented on the maps studied. The former predominate; and their locations are obviously controlled principally by those factors which control the locations of farms, houses, and roads.

Unless topographic factors are strong enough to exert a dominating influence, it would be expected that the location of mining towns would be controlled by the sites of the mines. In order to test this theory, the distinctively mining towns on the quadrangles from which type areas were studied have been listed and the data on the topography and on the locations of the mines and of the towns have been assembled in the following table:

TABLE SHOWING RELATIVE TOPOGRAPHY OF MINES AND MINING TOWNS

QUAD-RANGLE	NAME OF MINING TOWN	TOPOGRAPHY OF NEIGHBORHOOD OF MINE	LOCATION OF MINE	LOCATION OF TOWN
Holden, W. Va.	Holden Cora Stone Branch Kitchen	Mature Mature Mature Mature	Near bottom About 100 ft. up slope 150 ft. above main stream in gulley 150 ft. up slope	Bottom Bottom Bottom Bottom and on lower 50 ft. of slope
Eccles, W. Va.	Wevaco Dorothy Keeferton Kingston Herbertson	Mature Mature Mature Mature Late mature	800 ft. up slope About 1,000 ft. up slope 800 ft. up slope 500 ft. up slope and in valley heads 1,200 ft. up slope near top	Bottom Bottom Bottom Bottom On slope 100-150 ft. above stream
Canton, Ill.	Alden Mine No. 6 Alden Mine No. 5	Youthful Youthful	Upland Upland	Upland Upland
Several smaller communities: mines and communities both on uplands.				

The table shows that the mining towns are located in strict accord with the topography. On mature topography they are in the valley bottoms,

irrespective of the location of the mines; on the one example of late-mature topography the town is on the slope; and on the youthful topography all cultural features, including both mines and towns, are on the flat uplands.

The number of observations tabulated is, of course, too small for generalizations, but the table furnishes interesting confirmation of the results of the graphs and serves to indicate that topography is the controlling factor in the location of these mining towns as well as of the strictly rural communities.

*Roads.* With respect to the roads, the maps studied cover regions in which the road pattern is irregular and those in which the rectangular section-line system prevails. The latter system, if consistently carried out, must inevitably conflict seriously with the topography in any but plains regions, in which case either the section-line system must be modified or it must be followed in direct defiance of topography. By reference to the graph, Figure 1, it may be seen that for topography in the youthful stage the percentage of roads on uplands, bottoms, and slopes is about the same for the quadrangles, e. g., Canton, Centralia, and Colchester, in which the section-line plan has been followed, as for the quadrangles, e. g., Indian Head and Washington, in which the roads are not laid out with reference to any definite system. An inspection of the Canton map, Figure 4, shows that the section-line plan has been modified by means of jogs on one-half or one-fourth mile lines in such a way that the general plan is retained but the roads are located in reasonable conformation with the topography.

#### APPLICATION OF RESULTS

This paper represents only the beginning of the quantitative study of the distribution of population by a new method, and its conclusions, which are based upon limited data and are primarily applicable to those regions in which agriculture is the principal industry, should not be made the basis of unqualified generalizations. Especial importance is attached to the method and to the graphic representation of the results. The study was purposely confined to regions whose topography represents, as nearly as could be found, various stages in the ideal physiographic cycle as developed on dissected plains or plateaus. Obviously the results cannot be applied without modification to regions whose topography is complicated by remnants of surfaces belonging to two or more cycles or to those whose climatic and cultural conditions are notably different, and it is doubtful if it can be applied at all to regions—basin regions for example—whose topography is not definitely a product of the normal cycle of stream erosion, and such regions make up a very considerable portion of the earth's surface.

The location of cultural features and the distribution of population are controlled by a number of factors, among which topography, climate, the occupations of the people, and their grade of civilization are perhaps most important. The influence of topography on locations is conditioned to a greater or less degree by the other factors. In attempting to work out, on

a broad basis, the correlation between topography and the location of cultural features by the method outlined above, either of two plans may be adopted: (1) the correlation may be worked out separately for each principal type of climate and for each of the leading industries, or (2) certain conditions, e. g., humid climate and modern agriculture, may be taken as the *normal*, or perhaps better, the *standard* conditions, giving rise to the *normal* locations and distribution with respect to topography in the various stages of the ideal cycle; while variations from the normal brought about by complications of the cycle, different climatic conditions, different grade of civilization, or specialized industries may be considered as modifications due to particular causes. To illustrate: The accompanying graphs represent the correlation for a region of humid temperate climate where extensive modern agriculture is the dominant occupation of the people. Adopting the first plan, similar graphs might be prepared for regions where tree culture or grazing prevails or for those where intensive hoe cultivation is practiced. They might also be prepared for regions of arid, tropical, or cold climates. Following the second plan, which on the whole seems to be preferable, and accepting humid climate and modern agriculture as standard conditions, modifications of the normal locations and distribution would be recognized as such and related to their causes. For example, on youthful topography the normal is "upland culture," on late mature and old age topography it is "slope culture." In high altitudes, the climatic influence of elevation may make the uplands too cold and wet for habitation and compel settlement of the topographically unfavorable valley bottoms. Similarly, in an arid climate the necessity for irrigation may limit the culture of a young region to the valley bottoms. In the tropics, on the other hand, the cooler climate of the higher altitudes puts so high a premium upon altitude that not only may the flat uplands of youth be occupied to the fullest extent, but even the less favorable, narrow uplands of maturity may be utilized. Still greater altitude in the tropics, as in the Andes, may render the uplands fit only for the nomadic herdsman while the steeply sloping valley sides, on account of their more favorable climate, are laboriously cultivated. Each of these conditions brings about a modification of the normal distribution of cultural features which is easily traced to its cause.

Modifications of the normal locations due to complications of the cycle fit readily into the scheme. For instance in many parts of the Appalachian Plateau (see Big Bend quadrangle, W. Va.) late-mature topography has been rejuvenated and the bottoms of the broad valleys of the earlier cycle have been sharply trenched by the precipitous valleys of the new. With respect to the new cycle "upland culture" would be normal; with respect to the old cycle "slope culture" would be expected. As a matter of fact both expectations are fulfilled by the location of practically all cultural features on the gently sloping benches above the youthful valley sides.

The factors which constitute the basis of control exerted by topography—

namely relief, slope, and exposure—are so fundamental that it would seem that they must have weight whatever the industry or the stage in civilization may be, though either of the latter must modify the result. If modern agriculture, with machine cultivation and transportation by wheeled vehicles, be taken as the standard in determining the normal location of cultural features, then it would be expected that industries such as grazing or tree culture would introduce modifications in the direction of less absolute topographic control. So, also, would a stage in civilization in which transportation is primitive and cultivation is done by hand. An entirely non-agricultural and mobile industry like trapping would probably be so little controlled by topography that its correlation with stages of the cycle would be impracticable. Pressure of population or specialized industries resulting in terrace agriculture bring about modifications in the location of cultural features whose significance is the more marked when they are recognized as abnormalities due to specific causes. The location of cities and villages on crags and hilltops for defensive purposes offers another illustration of a modification of the normal readily recognized and easily traced to its cause.

Which of the plans mentioned above would yield the best results is open to discussion, but under either plan the application of the method to various parts of the world where climatic and cultural conditions are notably different is highly desirable.

#### BEARING OF LOCATION OF CULTURAL FEATURES ON THE BROADER PROBLEM OF THE INFLUENCE OF GEOGRAPHICAL ENVIRONMENT

If, in a given region, the location of houses, towns, and roads may be definitely correlated with the stage in the physiographic cycle, does it follow that the location of these features influences the life and character of its people? This is the ultimate problem to the solution of which this correlation is only the first step.

That the character of the topography exerts a very positive influence over the economic phases of life, and, through these, over the more subtle human qualities, will probably be conceded by all; but does the mere location exert a similar influence? To answer this question on a definite scientific basis will require long investigation, some of it distinctly in the realm of psychology, and will be the work of many years. A possible guiding principle may, however, be suggested. *The location of the farms, houses, and towns of a region determines the topographic environment and scenic outlook of the inhabitants.* Contrast, for example, the environment determined by youthful and by mature topography. In the one the people live on the uplands where they command the full sweep of land and sky. Their view is broad and open. In the other they live along the bottoms of the narrow, steep-sided valleys, hemmed in by hills. Their outlook is limited to their immediate surroundings; there are no broad commanding vistas.

The geographer can define the environment and classify and explain its elements: can the psychologist determine its effect in moulding character?